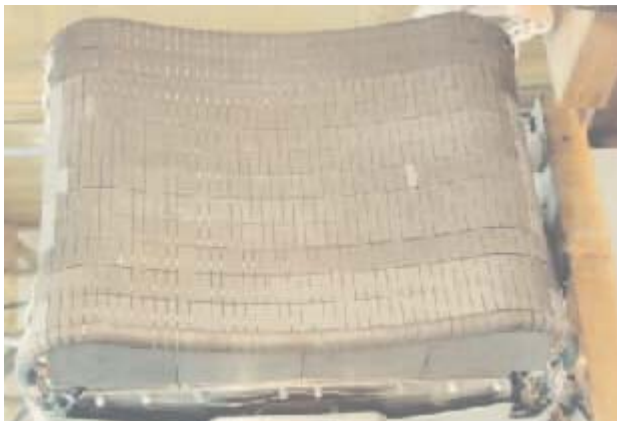


Joining & Heat-treating

Manufacturing Technologies

The joining and heat-treating technologies in the Thin Film, Vacuum, & Packaging department include brazing, heat-treating, diffusion bonding and soldering. The technical staff provides expertise in the filler metal selection, proper joint design, active filler metal brazing and the design of custom alignment fixtures. The department can join large complex parts or micro-mechanical devices of metal, ceramic and composite substrates.

Capabilities



Brazing large complex parts

- Conventional and active metal brazing of ceramics and cermets
- Binder burnout and densification of cermets and ceramics in reducing or inert atmospheres
- Hydrogen firing, inert gas, high vacuum or partial pressure heat treating
- Oxide coating (Greening) of Stainless

Steels using wet hydrogen processes

- Consulting with customers to define and qualify controlled atmosphere and vacuum furnaces for research and development
- Specify bonding interlayer materials for a variety of substrates
- Design of critical joints and selection of proper braze filler metal
- Multiple furnaces for brazing in vacuum, hydrogen or inert gas environments
- Deposition of thin film interlayers for diffusion bonding or ceramic brazing
- Design and manufacture fixtures for brazing and high-temperature treatments
- Perform/Specify step brazing processes for complex assemblies



Complex Graphite/Cu braze

- Diffusion bonding of metal, ceramic, and cermet substrates with thin film interlayers (silver, gold, copper, aluminum, and gold/copper alloy)

- Energetic multilayer thin film alternatives for brazing of heat-sensitive components. [Contact: David Adams (505) 844-8317, dpadams@sandia.gov]

Resources

- Employ wet and dry hydrogen and inert gas processing furnaces for state-of-the-art brazing and metal oxide reduction up to temperatures of 2000°C, particularly for stainless steels, nonferrous materials, high-temperature alloys, and refractory metals
- Three hydrogen or inert gas processing furnaces
- Three vacuum brazing furnaces, the largest with a 16 ft³ hot zone



Large Vacuum Furnace

- Large high-vacuum (10 E-08 torr) furnaces for treatments up to 1800°C
- Perform special bonding operations



High vacuum diffusion bonding

- Combination vacuum/hydrogen/inert furnace for specialized brazing and/or heat treatments
- Low temperature (< 600°C), vacuum or inert gas, diffusion bonding system designed for a 10 ton force
- Ready access to a broad spectrum of brazed/bonded joint interface characterization resources including: Optical Metallography, SEM, TEM, Microprobe, Tensile/Hardness Testers, Focused Ion Beam microfabrication system for cross-sectioning samples in targeted volumes

Accomplishments

- Demonstrated the feasibility of a thin-film metallization process as a cost-effective alternative to moly-manganese ceramic metallization methods
- Developed and demonstrated a robust, active braze process for joining copper, nickel and alumina for small telecommunications devices. (Small Business Initiative)
- Joined silicon nitride at 1450°C in a nitrogen environment. (External Customer)
- Hermetically joined low temperature co-fired ceramic (LTCC) to Kovar using an active braze process. (Internal Customer)
- Brazed fused silica to Kovar at 1000°C in a hydrogen atmosphere using an internally developed active braze filler metal

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